IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of:
Halbert Tam et al.

Serial No.: 10/074,345

Confirmation No.: 5690

Filed: February 12, 2002

For: STI POLISH ENHANCEMENT USING FIXED ABRASIVES WITH AMINO ACID ADDITIVES

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Group Art Unit: 3723

Examiner: Shantese L. McDonald

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July 28, 2006
Date

Steven H VerSteeg

Dear Sir:

APPEAL BRIEF

Applicants submit this Appeal Brief to the Board of Patent Appeals and Interferences on appeal from the decision of the Examiner of Group Art Unit 3723 dated January 12, 2006, finally rejecting claims 1-25 and 30-38. The final rejection of claims 1-25 and 30-38 is appealed. This Appeal Brief is believed to be timely since mailed by the due date of August 12, 2006, as set by mailing a Notice of Appeal on June 12, 2006. Authorization to charge the fee of $500.00 for filing this brief is provided on a separate fee transmittal. Please charge any additional fees that may be required to make this Appeal Brief timely and acceptable to Deposit Account No. 20-0782/APPM/006075.Y1/KMT.

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Real Party in Interest

The present application has been assigned to Applied Materials, Inc., 3050 Bowers Avenue, Santa Clara, California 95054.

Related Appeals and Interferences

Applicants assert that no appeals or interferences are known to the Applicants, the Applicants' legal representative, or assignee which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

Status of Claims

Claims 1-25 and 30-38 are pending in the application. Claims 1-32 were originally presented in the application. Claims 33-36 were added in Applicants' Response to Office Action dated September 18, 2003. Claims 37 and 38 were added in Applicants' Response to Office Action dated October 14, 2005. Claims 26-29 have been canceled without prejudice. Claims 1-25 and 30-38 stand finally rejected as discussed below. The final rejections of claims 1-25 and 30-38 are appealed. The pending claims are shown in the attached Claims Appendix.

Status of Amendments

Claims 1-32 were rejected by the Examiner in an office action dated June 18, 2003. Claim 17 was amended and claims 33-36 were added in a response filed September 18, 2003. Claims 1-36 were rejected in an office action dated December 19, 2003. No claims were amended in a response filed March 19, 2004. A notice of allowance was mailed on May 18, 2004. A Request for Continued Examination was filed on July 20, 2004. Claims 1-36 were rejected in an office action mailed February 9, 2005. Claims 1, 17, 30, and 33 were amended and claims 26-29 were canceled in a response filed April 22, 2005. Claims 1-25 and 30-36 were rejected in an office action mailed July 14, 2005. Claims 2 and 5 were amended and claims 37 and 38 were added in a response filed October 14, 2005. Claims 1-25 and 30-38 were rejected in a final office action mailed January 12, 2006. Arguments, but no claim amendments, were presented in a response filed April 12, 2006. In an advisory action mailed May 24, 2006, the Examiner indicated that the response would be entered. Therefore, all claim amendments have been entered by the Examiner, and no amendments to the claims were proposed after the final rejection.

Summary of Claimed Subject Matter

Claimed embodiments of the invention provide selectively removing dielectric material from a substrate (p. 8, paragraph [0018], lines 2-4).

In the embodiments of independent claim 1, a method for selectively removing a dielectric disposed on a substrate having a first dielectric material and a second dielectric material disposed thereon (p. 8, paragraph [0018], lines 2-4) is provided. The method comprises pre-polishing the substrate to planarize the substrate by removing a bulk overfill of the first dielectric material (p. 20, paragraph [0065], lines 1-5; and p. 20, paragraph [0066], lines 1-3); positioning the substrate in proximity with a fixed abrasive chemical mechanical polishing pad (p. 8, paragraph [0018], lines 4-5); dispensing a polishing composition having at least one organic compound therein between the substrate and the polishing pad (p. 8, paragraph [0018], lines 6-7); and chemical mechanical polishing the substrate (p. 8, paragraph [0018], line 7), wherein the at least one organic compound enhances the removal rate of the first dielectric material using the fixed abrasive chemical mechanical polishing pad without affecting the removal rate of the second dielectric material (p. 8, paragraph [0018], lines 7-9).

In the embodiments of independent claim 17, a method for processing a substrate to selectively remove an oxide material disposed on a nitride material (p. 8, paragraph [0019], lines 1-2) is provided. The method comprises pre-polishing the substrate to planarize the substrate by removing a bulk overfill of the oxide material (p. 20, paragraph [0065], lines 1-5; and p. 20, paragraph [0066], lines 1-3); positioning the substrate in proximity with a fixed abrasive chemical mechanical polishing pad (p. 8, paragraph [0019], lines 2-3); dispensing a polishing composition having at least one organic compound, at least one pH adjusting agent, and deionized water, between the substrate and the polishing pad (p. 8, paragraph [0019], lines 3-5), wherein the at least one organic compound enhances the removal rate of the oxide material using the fixed abrasive chemical mechanical polishing pad without affecting the removal rate of the nitride material; and removing the oxide material and the nitride material at a removal

rate ratio of the oxide material to the nitride material of about 10:1 or greater (p. 8, paragraph [0019], lines 6-7).

In the embodiments of independent claim 30, a polishing system for selectively removing dielectric material disposed on a substrate (p. 9, paragraph [0021], lines 1-2) is provided. The polishing system comprises a first polishing platen in proximity with the substrate (p. 9, paragraph [0021], lines 3-5); a second polishing platen having a fixed abrasive polishing pad disposed thereon and in proximity with the substrate for polishing the substrate (p. 20, paragraph [0066], lines 7-8); and a controller configured to cause the system to contact the substrate, such that the first polishing platen is in contact with the substrate, to remove a bulk overfill of a first dielectric material, and then to deliver to the substrate a polishing composition having at least one organic compound therein such that the polishing composition is in contact with the substrate and the fixed abrasive polishing pad, and to remove the first dielectric material at a higher removal rate than a second dielectric material, wherein the at least one organic compound enhances the removal rate of the first dielectric material using the fixed abrasive chemical mechanical polishing pad without affecting the removal rate of the second dielectric material (p. 9, paragraph [0021], lines 5-10).

In the embodiments of independent claim 33, a method of processing a substrate having a first material and a second material disposed thereon (p. 8, paragraph [0018], lines 2-4) is provided. The method comprises pre-polishing the substrate to planarize the substrate by removing a bulk overfill of the first dielectric material (p. 20, paragraph [0065], lines 1-5; and p. 20, paragraph [0066], lines 1-3); positioning the substrate in proximity with a fixed abrasive chemical mechanical polishing pad (p. 8, paragraph [0018], lines 4-5); dispensing a polishing composition having at least one amino acid, at least one pH adjusting agent, and deionized water, between the substrate and the fixed abrasive chemical mechanical polishing pad (p. 8, paragraph [0019], lines 3-5); chemical mechanical polishing the substrate; and removing the first material at a higher removal rate than the second material, wherein the at least one organic compound enhances the removal rate of the first material using the fixed abrasive chemical

mechanical polishing pad without affecting the removal rate of the second material (p. 8, paragraph [0018], lines 7-9).

Grounds of Rejection to be Reviewed on Appeal

Whether claims 1-25 and 30-38 are unpatentable under 35 U.S.C. § 103(a) over United States Patent No. 6,544,892 B2 to *Srinivasan et al.* in view of United States Patent No. 6,599,174 B1 to *Spikes, Jr.*

ARGUMENTS

Claims 1-25 and 30-38 are not obvious over United States Patent No. 6,544,892 B2 to *Srinivasan et al.* in view of United States Patent No. 6,599,174 B1 to *Spikes, Jr.*

Claims 1-25 and 30-38 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over United States Patent No. 6,544,892 B2 to *Srinivasan et al.* in view of United States Patent No. 6,599,174 B1 to *Spikes, Jr.* on the grounds that *Srinivasan et al.* in view of *Spikes, Jr.* suggests a two step polishing process using at least one organic compound. Applicants have respectfully traversed the rejections based on failure of *Srinivasan et al.* in view of *Spikes, Jr.* to teach or suggest the claimed subject matter.

Srinivasan et al. discloses a one step polishing method in which glycine is present in the polishing slurry. *Srinivasan et al.* does not disclose a pre-polishing step or multiple polishing steps as the Examiner has stated (see Advisory Action dated May 24, 2006).

Spikes, Jr. discloses a two step polishing process. In the first polishing step, a slurry is provided to the polishing pad to remove material from a layer (see col. 8, l. 10-48). Thereafter, a second polishing process occurs. The second polishing process occurs substantially slurryless (col. 9, l. 1-19). There is no teaching to have slurry present for the second polishing step. *Spikes, Jr.* also does not teach a pre-polishing step.

Modifying *Srinivasan et al.* with *Spikes, Jr.* as the Examiner has suggested does not render the claims obvious. The Examiner has stated that the "*Spikes, Jr.* reference was cited and teaches that a pre-polish step during the planarization of a substrate with dielectric polishing layers, and during a polishing procedure with multiple polishing steps, is a known procedure in the art" (see page 4 of the final office action mailed January 12, 2006; Advisory Action dated May 24, 2006). Presumably, the Examiner is stating that rather than using the one step polishing process taught by *Srinivasan et al.*, one of ordinary skill in the art, when confronted with *Spikes, Jr.*, would perform the

multiple step process taught by *Spikes, Jr.* while using the amino acid in the polishing slurry taught by *Srinivasan et al.*

Even assuming that the examiner is correct that one of ordinary skill in the art would change *Srinivasan et al.* to a multi-step polishing process using the amino acid, the second polishing step would not have a polishing slurry as currently claimed. Additionally, no slurry would be provided before the second polishing step because *Spikes, Jr.* explicitly teaches that the slurry is removed between polishing steps. Neither *Srinivasan et al.* nor *Spikes, Jr.* teach providing a polishing slurry prior to the second polishing step as required by claims 1, 17, 30, and 33.

Srinivasan et al. and *Spikes, Jr.* do not suggest that a polishing slurry is provided to the surface after the first polishing step as required by claims 1, 17, 30, and 33. Additionally, *Srinivasan et al.* and *Spikes, Jr.* do not teach or suggest a controller that is configured to cause a system to pre-polish, dispense a polishing composition having at least one organic compound, and chemical mechanical polish a layer as required by claim 30 and claims dependent thereon.

Therefore, *Srinivasan et al.* and *Spikes, Jr.*, either alone or in combination, do not teach, show, or suggest a method for selectively removing a dielectric disposed on a substrate having a first dielectric material and a second dielectric material disposed thereon wherein the method comprises pre-polishing the substrate to planarize the substrate by removing a bulk overfill of the first dielectric material, positioning the substrate in proximity with a fixed abrasive chemical mechanical polishing pad, dispensing a polishing composition having at least one organic compound therein between the substrate and the polishing pad, and chemical mechanical polishing the substrate, wherein the at least one organic compound enhances the removal rate of the first dielectric material using the fixed abrasive chemical mechanical polishing pad without affecting the removal rate of the second dielectric material, as claimed in claim 1 and claims dependent thereon.

Likewise, *Srinivasan et al.* and *Spikes, Jr.*, either alone or in combination, do not teach, show, or suggest a method for processing a substrate to selectively remove an oxide material disposed on a nitride material wherein the method comprises pre-polishing the substrate to planarize the substrate by removing a bulk overfill of the oxide

material, positioning the substrate in proximity with a fixed abrasive chemical mechanical polishing pad, dispensing a polishing composition having at least one organic compound, at least one pH adjusting agent, and deionized water, between the substrate and the polishing pad, wherein the at least one organic compound enhances the removal rate of the oxide material using the fixed abrasive chemical mechanical polishing pad without affecting the removal rate of the nitride material, and removing the oxide material and the nitride material at a removal rate ratio of the oxide material to the nitride material of about 10:1 or greater, as claimed in claim 17 and claims dependent thereon.

Similarly, *Srinivasan et al.* and *Spikes, Jr.*, either alone or in combination, do not teach, show, or suggest a polishing system for selectively removing dielectric material disposed on a substrate wherein the polishing system comprises a first polishing platen in proximity with the substrate, a second polishing platen having a fixed abrasive polishing pad disposed thereon and in proximity with the substrate for polishing the substrate, and a controller configured to cause the system to contact the substrate, such that the first polishing platen is in contact with the substrate, to remove a bulk overfill of a first dielectric material, and then to deliver to the substrate a polishing composition having at least one organic compound therein such that the polishing composition is in contact with the substrate and the fixed abrasive polishing pad, and to remove the first dielectric material at a higher removal rate than a second dielectric material, wherein the at least one organic compound enhances the removal rate of the first dielectric material using the fixed abrasive chemical mechanical polishing pad without affecting the removal rate of the second dielectric material, as claimed in claim 30 and claims dependent thereon.

Lastly, *Srinivasan et al.* and *Spikes, Jr.*, either alone or in combination, do not teach, show, or suggest a method of processing a substrate having a first material and a second material disposed thereon wherein the method comprises pre-polishing the substrate to planarize the substrate by removing a bulk overfill of the first dielectric material, positioning the substrate in proximity with a fixed abrasive chemical mechanical polishing pad, dispensing a polishing composition having at least one amino acid, at least one pH adjusting agent, and deionized water, between the substrate and

the fixed abrasive chemical mechanical polishing pad, chemical mechanical polishing the substrate; and removing the first material at a higher removal rate than the second material, wherein the at least one organic compound enhances the removal rate of the first material using the fixed abrasive chemical mechanical polishing pad without affecting the removal rate of the second material, as claimed in claim 33 and claims dependent thereon.

CONCLUSION

The Examiner errs in finding that the combination of *Srinivasan et al.* and *Spikes, Jr.* is sufficient to reject claims 1-25 and 30-38. It is respectfully requested that the Examiner's rejection of claims 1-25 and 30-38 be reversed.

Respectfully submitted,

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CLAIMS APPENDIX

1. (Previously Presented) A method of selectively removing a dielectric disposed on a substrate having a first dielectric material and a second dielectric material disposed thereon, comprising:

pre-polishing the substrate to planarize the substrate by removing a bulk overfill of the first dielectric material;

positioning the substrate in proximity with a fixed abrasive chemical mechanical polishing pad;

dispensing a polishing composition having at least one organic compound therein between the substrate and the polishing pad; and

chemical mechanical polishing the substrate, wherein the at least one organic compound enhances the removal rate of the first dielectric material using the fixed abrasive chemical mechanical polishing pad without affecting the removal rate of the second dielectric material.

2. (Previously Presented) The method of claim 1, wherein the at least one organic compound is selected from the group consisting of amino acids and combinations thereof.

3. (Original) The method of claim 2, wherein the amino acid comprises glycine.

4. (Original) The method of claim 1, wherein the at least one organic compound forms between about 0.01 weight percentage (wt. %) and about 20 wt. % of the polishing composition.

5. (Previously Presented) The method of claim 1, wherein the polishing composition further comprises at least one pH adjusting agent, deionized water, or combinations thereof.

6. (Original) The method of claim 1, wherein the polishing composition is an abrasive free composition and comprises between about 1 wt. % and about 8 wt. % glycine, deionized water, and potassium hydroxide as the pH adjusting agent.

7. (Original) The method of claim 1, wherein the pH of the polishing composition is about 7 or more.

8. (Original) The method of claim 1, wherein the pH of the polishing composition is between about 9 and about 12.

9. (Original) The method of claim 1, wherein the substrate includes a shallow trench isolation structure comprising the first and second dielectric layers.

10. (Original) The method of claim 9, wherein at least one of the first and second dielectric materials comprises a nitride layer.

11. (Original) The method of claim 1, wherein the first dielectric material has a first removal rate and the second dielectric material has a second removal rate less than the first removal rate.

12. (Original) The method of claim 11, wherein the first dielectric material is silicon oxide and the second dielectric material is silicon nitride.

13. (Original) The method of claim 11, wherein the silicon oxide is removed at a rate between about 50 Å/min and about 5000 Å/min.

14. (Original) The method of claim 13, wherein the silicon nitride is removed at a rate between about 0.01 Å/min and about 300 Å/min.

15. (Original) The method of claim 11, wherein the silicon oxide and the silicon nitride are removed at a removal rate ratio of about 10:1 or greater.

16. (Original) The method of claim 11, wherein the silicon oxide and the silicon nitride are removed at a removal rate ratio from about 100:1 to about 2000:1.

17. (Previously Presented) A method of processing a substrate to selectively remove an oxide material disposed on a nitride material, comprising:

pre-polishing the substrate to planarize the substrate by removing a bulk overfill of the oxide material;

positioning the substrate in proximity with a fixed abrasive chemical mechanical polishing pad;

dispensing a polishing composition having at least one organic compound, at least one pH adjusting agent, and deionized water, between the substrate and the polishing pad, wherein the at least one organic compound enhances the removal rate of the oxide material using the fixed abrasive chemical mechanical polishing pad without affecting the removal rate of the nitride material; and

removing the oxide material and the nitride material at a removal rate ratio of the oxide material to the nitride material of about 10:1 or greater.

18. (Original) The method of claim 17, wherein the oxide material is silicon oxide and the nitride material is silicon nitride.

19. (Original) The method of claim 17, wherein the oxide material and the nitride material are removed at a removal rate ratio of the oxide material to the nitride material from about 100:1 to about 2000:1.

20. (Original) The method of claim 17, wherein the at least one organic compound comprises amino acids and combinations thereof.

21. (Original) The method of claim 17, wherein the at least one organic compound comprises glycine.

22. (Original) The method of claim 17, wherein the at least one organic compound forms between about 0.01 wt. % and about 20 wt. % of the polishing composition.

23. (Original) The method of claim 17, wherein the polishing composition is an abrasive free composition and comprises between about 1 wt. % and about 8 wt. % of glycine, deionized water, and potassium hydroxide as the pH adjusting agent.

24. (Original) The method of claim 17, wherein the pH of the polishing composition is about 7 or more.

25. (Original) The method of claim 17, wherein the pH of the polishing composition is between about 9 and about 12.

26-29. (Canceled)

30. (Previously Presented) A polishing system for selectively removing dielectric material disposed on a substrate, comprising:

a first polishing platen in proximity with the substrate;

a second polishing platen having a fixed abrasive polishing pad disposed thereon and in proximity with the substrate for polishing the substrate; and

a controller configured to cause the system to contact the substrate, such that the first polishing platen is in contact with the substrate, to remove a bulk overfill of a first dielectric material, and then to deliver to the substrate a polishing composition

having at least one organic compound therein such that the polishing composition is in contact with the substrate and the fixed abrasive polishing pad, and to remove the first dielectric material at a higher removal rate than a second dielectric material, wherein the at least one organic compound enhances the removal rate of the first dielectric material using the fixed abrasive chemical mechanical polishing pad without affecting the removal rate of the second dielectric material.

31. (Original) The system of claim 30, further comprising:

a carousel;

at least one substrate head assembly suspended from the carousel and capable of holding a substrate thereon; and

a positioning member coupled to the carousel to move the carousel and to position the substrate head assembly over the polishing platen.

32. (Original) The system of claim 30, wherein the polishing platen is a linear web, a linear belt platen, or a rotatable platen.

33. (Previously Presented) A method of processing a substrate having a first material and a second material disposed thereon, comprising:

pre-polishing the substrate to planarize the substrate by removing a bulk overfill of the first dielectric material;

positioning the substrate in proximity with a fixed abrasive chemical mechanical polishing pad;

dispensing a polishing composition having at least one amino acid, at least one pH adjusting agent, and deionized water, between the substrate and the fixed abrasive chemical mechanical polishing pad;

chemical mechanical polishing the substrate; and

removing the first material at a higher removal rate than the second material, wherein the at least one organic compound enhances the removal rate of the first material using the fixed abrasive chemical mechanical polishing pad without affecting the removal rate of the second material.

34. (Previously Presented) The method of claim 33, wherein the first material is an oxide material and the second material is a nitride material.

35. (Previously Presented) The method of claim 33, wherein the at least one amino acid is selected from the group consisting of glycine, proline, arginine, lysine, and combinations thereof.

36. (Previously Presented) The method of claim 33, wherein the at least one amino acid forms between about 0.01 wt. % and about 20 wt. % of the polishing composition.

37. (Previously Presented) The method of claim 2, wherein the amino acid comprises proline.

38. (Previously Presented) The method of claim 20, wherein the amino acid comprises proline.

EVIDENCE APPENDIX

NONE

RELATED PROCEEDINGS APPENDIX

NONE